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THE CHALLENGES OF INTEGRATING INTO SUPPLY CHAIN NETWORKS: THE CASE OF GHANAIAN MANUFACTURING FIRMS

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ABSTRACT

This study screens for the challenges associated with firms' integration into supply chain networks in the Ghanaian manufacturing sector. A quantitative research approach was employed. The study population was senor supply chain employees in selected manufacturing firms in Accra, Ghana. Simple random sampling technique was used to select 350 respondents. Data was collected using a self-administered questionnaire. Results of the study produced 3 components of challenges that hinder integration into supply chain networks. The first component of challenges named *business micro-environment challenges* accounts for 53.7% of the variation. The second component of challenges named *business macro-environment challenges*, accounts for 27.6% of the variation. The third component of challenges constitutes technical challenges, and this accounts for 8.2% of the variation. Firms would therefore have to remedy challenges in each component to maximise the effectiveness of integration into supply chain networks, but they must give priority to challenges having the highest variations.

KEYWORDS: Supply Chain, Supply Chain Management, Supply Chain Networks, Integration Into Supply Chain Networks

INTRODUCTION

Supply chain is among the major organisational functions on which growth depends. As a result, firms would have to develop and implement suitable plans and policies in their supply chain management endeavours. This implies that the effectiveness of supply chain management (SCM) within the organisation is key to performance and growth. Supply chain management has been defined as "the network of organisations which are involved through upstream and downstream linkages in different processes and activities that create value in the form of products and services in the hands of customers" Sarpong, Otchere & Anin (2013, p. 192). The goal of supply chain management is to integrate and harmonise the internal organisational cross-functions with the external operations of suppliers, customers, and other channel members as a basis of achieving competitive advantage and success (Naslund & Williamson, 2010; Sarpong et al., 2013). Many researchers (e.g. Skjott-Larsen & Bagchi, 2002; Toyin, 2012) have argued that growth of firms is impossible without supply chain management. Even so, the impact of SCM on the organization is said to be based on the effectiveness of integrating into supply chain networks (Westbrook, 2002).

Westbrook (2002) defines a supply chain network as one which constitutes the chain of people, customers and suppliers and the processes binding them, along which goods and services are exchanged or transferred. Every SCM process comes with a supply chain network, which serves as a medium for the exchange and transfer of goods and services through the facilitation of information (Westbrook, 2002; Awad & Nasser, 2010a). A supply chain network may be considered as a conduit of information, which serves as a fluid through which processes, goods, services and strategies are

exchanged. The role of the supply chain network in supply chain depends on integration into it by the firm and other stakeholders such as customers, suppliers and others (Awad & Nasser, 2010a; 2010b). To ensure effective integration into supply chain networks, there is the need to hedge against its associated challenges (Awad & Nasser, 2010a; Agyei, Sarpong & Anin, 2013).

There seem to be a consensus among researchers about challenges associated with integration into supply chain networks. Invariably, empirical evidences point to a common set of challenges that firms face in integrating into supply chain networks. Awad & Nasser (2010a), Awad & Nasser (2010b), Carter, Monczka, Ragatz & Jennings (2009) and other researchers have revealed three components of challenges faced in integrating into supply chain networks. These components are: (1) organisational micro-environment challenges; (2) organisational macro-environment challenges; and (3) technical challenges. The first component comes with internal organisational issues that hinder connection with supply chain networks (Awad & Nasser, 2010a). The second component is composed of issues relating to the macro-economy, while the third component contains challenges associated with use of technology and data (Awad & Nasser, 2010a; Awad & Nasser, 2010b).

A survey of studies have revealed that empirical evidences on the challenges associated integrating into supply chain networks have not much been contributed in a Ghanaian point of view. Though some researches exist on SCM in a Ghanaian context, there are no identifiable studies on the subject in a Ghanaian context. Thus academic debate on this subject from a Ghanaian perspective is poor. Moreover, Awad & Nasser (2010) posit that the challenges and the categories to which they belong must be identified using Principal Component Analysis (PCA). Suhr (1999) also recommends PCA for analysing data with several dimensions. The problem is that most of the studies conducted are blind to PCA application.

This study is therefore conducted to screen for the challenges associated with integration into supply chain networks in the manufacturing sector in Ghana. The study provides evidence on the subject in a Ghanaian context, providing a basis for improving integration into supply chain networks in manufacturing firms in Ghana. The study is limited to the manufacturing sector owing to the intensity of supply chain operations in this sector in Ghana.

OBJECTIVE OF THE STUDY

This paper explores the various challenges faced by manufacturing firms in integrating into supply chain networks in Ghana. In this study, Principal Component Analysis is used to categorise these challenges in terms of how much the hinder integration into supply chain networks in Ghana.

The study provides empirical evidence on the prevalence of these challenges in Ghana considering the fact that academic debate on the subject in a Ghanaian context is very weak. The study therefore contributes to academic debate on the subject and enriches its literature from a Ghanaian perspective. Last but not least, this paper enriches practitioners and managements with knowledge about the challenges associated with integrating into supply chain networks, forming a basis for remedying these challenges in practice.

REVIEW OF LITERATURE

There are various definitions of supply chain. Chiu (1995), defines supply chain is a system of organisations, people, activities, information, and resources involved in moving a product or service from supplier to customer. A supply chain is also a network of organisations, people, activities, information, and resources that form the mechanism and process

of conveying products and services to customers through suppliers (Enporion Inc, 2009). Activities of supply chain transform natural resources, raw materials, and components into a finished product that is delivered to the end customer through a retailer (Chiu, 1995; Kuei & Madu, 2001).

Apart from the definition of Sarpong et al. (2013), many other definitions of SCM exist. Supply chain management is also defined as the integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders (Lambert, 2008). From a personal viewpoint, supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes the crucial components of coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers.

The basic goal behind a supply chain is to facilitate business activities towards organisational growth. This is because organisations recognise the need to rely on effective supply chains to compete in the local and global market place (Wagner et al., 2012; Okino & Cattini, 2011). Moreover, this concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies (Wagner et al., 2012). In view of this, the impact of SCM on the firm is said to be based on the effectiveness of integrating into supply chain networks (Westbrook, 2002; Georgise, Klause-Dieter & Seifert, 2014).

A supply chain network is the chain of people in the firm, its customers and suppliers and the processes binding them, through which goods and services are exchanged or transferred (Westbrook, 2002). Supply chain networks basically make up the core attribute of SCM and serve as an interconnected medium for the exchange and transfer of goods and services through the facilitation of information flow (Westbrook, 2002; Awad & Nasser, 2010a). A supply chain network could be the link among the various stakeholders in a proverbial supply chain process. Moreover, the role of the supply chain network depends on integration into it by the firm and other stakeholders such as customers, suppliers and business intermediaries (Awad & Nasser, 2010a; 2010b). Integration into a supply chain network means creating the right connections and links among people and processes to engender expected results (Awad & Nasser, 2010a). It also involves proper initiation, creation and management of the expected relationship among people (all stakeholders) and processes in SCM (Georgise et al., 2014).

Integration into supply chain networks is fraught with challenges. Therefore to ensure effective integration into supply chain networks, there is the need to hedge against its associated challenges (Awad & Nasser, 2010a; Agyei, Sarpong & Anin, 2013). Empirical studies have revealed a common set of challenges faced by firms in integrating into supply chain networks. The most recognised set of challenges are produced in the study of Awad & Nasser (2010a; 2010b). These researchers placed the challenges into components, namely (1) organisational micro-environment challenges; (2) organisational macro-environment challenges; and (3) technical challenges. Table 7 in the Appendix shows these components and their constituent elements. The first component comes with internal organisational issues that hinder connection with supply chain networks (Awad & Nasser, 2010a). The second component is composed of issues emanating from the macro-economy or the national social environment, while the third component contains challenges associated with the use of technology and data in SCM (Awad & Nasser, 2010a; Awad & Nasser, 2010b).

In Ghana, especially in its manufacturing sector where SCM is much carried out, there is little knowledge on challenges associated with integration into supply chain networks. This is logically as a result of lack of accessible empirical evidences on the subject from a Ghanaian point of view. Some studies (e.g. Adjei et al., 2013; Annan et al.,

2013; Otchere et al., 2013; Sarpong et al., 2013; etc.) have conducted studies on SCM and its challenges, but these studies are not fine-tuned to integration into supply chain networks. Moreover, challenges identified in most related studies are not placed in components that serve as a basis of knowing which cluster of challenges hinder integration into supply chain networks most (Awad & Nasser, 2010a). Generally too, academic debate on the subject leaves much to be desired in view of the limited number of studies conducted on it. In view of these gaps in the literature and the need to contribute to their remedy, this study is conducted using data from Ghana's manufacturing sector. It is hypothesized that items shown in Table 7 in the Appendix are areas of the challenges faced by manufacturing firms in integrating into supply chain networks in Ghana. Thus each of the items is a source of hindrance in integrating into supply chain networks among manufacturing firms in Ghana.

METHODOLOGY

This paper adopts a quantitative research approach in view of the need to use Principal Component Analysis in screening for the hypothesised challenges. Principal Component Analysis is a quantitative statistical tool; hence its application is primarily expected to take place in a quantitative study (Suhr, 1999; Ringner, 2008). The advantage of using the PCA is that it makes way for categorising challenges in terms of their level of influence on integration into supply chain networks.

The population of this study was supply chain management employees in the head offices of selected manufacturing firms in Ghana. These chosen firms are Accra Brewery Limited, Tulow Oil, Fan Milk, Ash Foam Ghana, Ghana Cement, and Newmont Ghana Limited. These firms were chosen because their supply chain processes are regular and rigorous. Moreover unlike other manufacturing firms, access to data was guaranteed with these firms. The sampling frame of the study was made up of senior management members working at the head offices of the firms. The study was limited to the head offices because we assumed that data from the head offices would reflect situations of supply chain management across all branches in Ghana. Members of the sampling frame were also required to have worked for at least two (2) years in their respective firms, ensuring that their responses were based on ample experience with the firm's supply chain processes.

The sampling frame of this study had 554 employees. By using Krejcie & Morgan's (1970) sampling principle and table, it was realised that a sample size of 226 people corresponds to the number of members in the sampling frame. Yet, the PCA works best with a sample size of at least 300 (Ringner, 2008). Hence, the sample size of 226 was increased to 350, making room for nonresponses. Krejcie & Morgan (1970) agree with this upward adjustment of sample size. The sample size was determined using the balloting method of the simple random sampling method. This sampling procedure was used in view of the interest of the researchers to make the sample representative of the study population by giving each member an equal chance of being selected into the sample.

A self-administered questionnaire was used to collect data. This instrument was designed to measure all hypothesised challenges faced in integrating to supply chain networks. Items used in this respect were borrowed from the study of Awad & Nassar (2010a). Measurement was done on a five-point likert scale [strongly disagree (1); disagree (2); neutral (0); agree (4); strongly agree (5)]. Some measures were taken to ensure that this instrument was valid and reliable. Firstly, it was submitted to some research experts on the subject for review and validation. Secondly, it was used in a pilot study on a small sample taken from the target population. This pilot study made way for improving the validity of the instrument.

Data was collected by both hand and electronic (e-mail) deliveries of questionnaires. Out of 350 questionnaires administered, 323 were completed but 312 were incorporated into data analysis. This means that 11 questionnaires were discarded owing to response errors that could not be rectified. In essence, an appreciable response rate of 89% was realised in this study. A reliability coefficient of 0.873 was also realised using SPSS Version 21. Evidently, the instrument used in data collection was reliable.

Data was analysed generally with SPSS Version 21. This statistical tool was used in view of its robustness for Principal Component Analysis. Thus data was analysed using PCA. It was ensured that all diagnostic tests associated with the PCA were duly done. Results of the study are presented in the next section.

RESULTS

This study screens for challenges associated with integration into supply chain networks in manufacturing firms in Ghana. In this section, results of the study are presented, and the PCA is used to screen for these challenges and to categorise them on the basis of which of them hinders integration into supply chain networks most. The validity of the PCA is however dependent on results of some diagnostic tests associated with it. The first of these tests is the KMO and Bartlett's test shown in Table 1.

Table 1: KMO and Bartlett's Tests

KMO Value		0.876
Bartlett's test of Sphericity	Chi-square	564.322
	p-value	0.000

Table 1 shows results of the KMO and Bartlett's test of sphericity. These tests are used to verify the appropriateness of the study's sample and the validity of the PCA. If the study's sample is appropriate and the PCA is valid, the KMO value would be equal or greater than 0.70 (Suhr, 1999). Moreover, the Bartlett's test would be significant at the chosen level of significance. At a level of significance of 5%, results of these two tests indicate that the PCA is associated with an appropriate and the PCA itself is valid. Yet, another test must be used to confirm the validity of the PCA. Results of this test are seen in Table 2.

Table 2: Anti-Image Correlations

Variable	Anti-Image Correlations
Transaction cost	0.897
Strategic flexibility management	0.984
Strategic planning management	0.876
Customer order management	0.898
Logistic management	0.765
Operation flexibility	0.811
Measure of SC benefits	0.903
Standard of trade	0.832
Procurement management	0.888
Enterprise integration	0.903
Business process integration	0.933

Table 2 - Cond.,

Culture and change	0.789
Supplier competence requirement	0.976
Business transformation oriented to globalization	0.799
Effect of globalization	0.821
Data and information integration	0.943
Application integration	0.877
Extranet adoption	0.888

Table 2 shows the Anti-image correlations of all manifest variables. The general rule of thumb is that each variable must have an anti-image correlation value not less than 0.70 (Suhr, 1999; Ringner, 2008). From the table, this requirement is satisfied. It is therefore fully confirmed that the PCA used in this study is valid. The rest of the tables come with actual results of the study.

Table 3: Communalities

	Initial	Extraction
Transaction cost	1.000	.941
Strategic flexibility management	1.000	.968
Strategic planning management	1.000	.923
Customer order management	1.000	.964
Logistic management	1.000	.957
Operation flexibility	1.000	.937
Measure of SC benefits	1.000	.914
Standard of trade	1.000	.946
Procurement management	1.000	.862
Enterprise integration	1.000	.884
Business process integration	1.000	.992
Culture and change	1.000	.958
Supplier competence requirement	1.000	.975
Business transformation oriented to globalization	1.000	.973
Effect of globalization	1.000	.968
Data and information integration	1.000	.988
Application integration	1.000	.988
Extranet adoption	1.000	.959
Extraction Method: Principal Component Analysis.		

In the context of the PCA, communalities are used to identify manifest variables extracted from the analysis. The general rule is that variables having extraction values less than 0.50 are extracted from the analysis. In Table 3, it is evident that no manifest variable is extracted from the PCA. This implies that all variables in this table represent challenges associated with integration into supply chain networks in the manufacturing firms in Ghana. The higher the extraction value, the higher the extent of hindrance posed by a challenge. In the next table, the number of components formed by these challenges and the variations accounted by each component are seen.

Table 4: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.665	53.697	53.697	9.665	53.697	53.697	5.467	30.375	30.375
2	4.960	27.555	81.251	4.960	27.555	81.251	5.043	28.016	58.390
3	1.469	8.161	89.412	1.469	8.161	89.412	4.812	26.735	85.125
Extraction Method: Principal Component Analysis.									

Table 4 shows the number of components formed by extracted variables or challenges and the variations accounted by each component. From the table, 3 components are formed. The first component of challenges accounts for about 53.7% of the variation; the second component of challenges account for about 27.6% of the variation; and the third component of challenges accounts for about 8.2% of the variation. A total of 85.1% of the variation is accounted. The higher the variation accounted by a component, the more serious its constituent challenges could be reckoned. In Table 5, the constituent challenges of each component are identified.

Table 5: Component Matrix[a]

	Component		
	1	2	3
Transaction cost	**0.83**	0.182	-0.379
Strategic flexibility management	**0.933**	0.097	-0.293
Strategic planning management	**0.898**	-0.112	-0.283
Customer order management	**0.794**	-0.389	-0.418
Logistic management	**0.897**	0.35	-0.145
Operation flexibility	**0.841**	0.468	-0.101
Measure of SC benefits	**0.433**	0.723	-0.345
Standard of trade	**0.934**	0.125	0.124
Procurement management	**0.645**	-0.306	0.307
Enterprise integration	**0.458**	0.363	0.651
Business process integration	0.662	-0.666	**0.157**
Culture and change	0.73	-0.565	**0.168**
Supplier competence requirement	0.869	-0.312	**0.264**
Business transformation oriented to globalization	0.88	-0.333	**0.247**
Effect of globalization	0.801	-0.511	**0.092**
Data and information integration	0.306	**0.913**	0.213
Application integration	0.306	**0.913**	0.213
Extranet adoption	0.379	**0.864**	0.132

In Table 5, variables of components have values in bold font. The first component has the highest number of constituent challenges. This might be the reason it accounts for the highest variation. Some of its constituents are transaction cost, strategic flexibility management issues and strategic planning management issues. The second component is made up of variables such as business process integration problems, and culture and change. The third component is made up of data and information integration problems, application integration issues and extranet adoption. To better understand these components, they are conceptualized as shown in Figure 1.

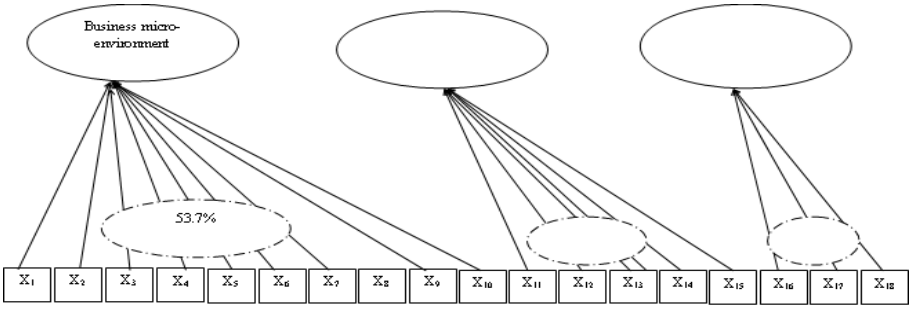

Figure 1: Resulting Model

In Figure 1, constituents of the three components extracted are shown with their variations accounted. In the figure, X_1, X_2, X_3 … X_{18} represent manifest variables in Table 5. X_1 to X_{10} makes up the first component, *business micro-environment*, with 53.7% of variation accounted. The second component, *business macro-environment*, is made up of X_{11} to X_{15} with a variation of 27.6% accounted. The third component, *technical challenges*, is made up of X_{16}, X_{17} and X_{18} with a variation of 8.2% accounted. In this study, it seems that the variations accounted are proportional to the number of variables in the components. Hence, the actual effect of each component and challenge can be found by considering extraction values of variables in Table 3. Generally, all challenges hypothesised based on evidences from previous studies are retained in this study in the context of supply chain in the manufacturing firms in Ghana.

DISCUSSIONS

The three components of challenges associated with integration into supply chain networks, as identified in some previous studies, are all retained in this study in the context of manufacturing firms in Ghana. This means that frameworks found in some studies like Awad & Nasser (2010a), Awad & Nasser (2010b) and Carter et al. (2009) are supported in a Ghanaian context. This implies that supply chain management processes in the manufacturing sector in Ghana are similar to those practiced in the foreign countries in which these previous studies were conducted and possibly other countries. The challenges are therefore very likely to apply to all geographical areas and sectors. Yet, more empirical evidences are needed in this respect as recommended by Awad & Nasser (2010b).

To maximise the effectiveness of SCM and integration into supply chain networks, there is the needed to remedy these confirmed challenges based on their magnitude of effect (Carter et al., 2009; Awad & Nasser, 2010a). To know their magnitude of effect, one must call to mind the variations accounted by each component and the communalities or extraction values produced on each variable in the context of the PCA. Factually, manufacturing firms have two options: (1) to remedy challenges from the viewpoint of the components; and (2) to remedy challenges from the viewpoint of individual areas of the challenges.

The first component of challenges found is *business micro-environment*, which accounts for 53.7% of the total variation. In essence, firms would have to give utmost priority to remedying these challenges collectively. These challenges are issues relating to internal organisational activities, policies and situations. In Table 7 in the appendix, one of these situations is item 1; *transaction cost*. Thus transaction costs could become hindrances to integration to supply change networks, especially for firms having budgetary and financial problems (Westbrook, 2002; Toyin, 2012).

The second component of challenges is *business macro-environment*, which accounts for 27.6% of the total variation. Obviously, these challenges are not collectively as serious as those found within the firm's operational environment; thus those in component 1. The fact that the first component accounts for more than 50% of the total

variation means that firms have a greater chance of determining success in integrating into supply chain networks, as well as reaching expected results in SCM. The third component of challenges constitutes *technical challenges*, and this accounts for 8.2% of the total variation. These challenges could be internal or external, depending on how data and technology is applied in SCM.

Organisations might wish to prioritise remedy to each of the areas of the challenges. In this respect, they must consider the extraction value of each area or item as seen in Table 3. In this table, "business process integration" has the highest extraction value. This means this variable deserves utmost priority among all individual areas of the challenges though it belongs to the component with the lowest variation. So, the use of the PCA unfolds which groups and individual challenges to remedy first (Awad & Nasser, 2010a), and this information is useful in situations where there is the need to optimise resources in hedging these challenges. It can be seen in Table 3 that variables of components 2 and 3 have higher extraction values relative to component 1. This confirms that the high number of variables in component 1 forms a basis of its contribution of the highest variation. So if decisions should be made without considering the components and their variations, firms in Ghana would have to give priority to individual items in components 2 and 3 instead of those in component 1.

CONCLUSIONS AND RECOMMENDATIONS

All challenges hypothesised to hinder integration into supply chain networks have been retained in this study. These challenges account for a total of 85.1% of the variation. The first component of challenges constitutes business micro-environment challenges (i.e. challenges faced within the organisation). They account for the highest variation or influence (53.7%) on integration into supply chain networks. The second component of challenges constitutes business macro-environment challenges (i.e. challenges faced at the macro-economic level). They account for the second highest variation or influence (27.6%) on integration into supply chain networks. The third component of challenges constitutes technical challenges (i.e. challenges associated with information technology and data-related problems). They account for the least variation or influence (8.2%) on integration into supply chain networks. Table 6 shows challenges associated with each component.

Table 6: Summary

Variable	Notation	Variation Accounted
Transaction cost	Business micro-environment	53.70%
Strategic flexibility management		
Strategic planning management		
Customer order management		
Logistic management		
Operation flexibility		
Measure of SC benefits		
Standard of trade		
Procurement management		
Enterprise integration		
Business process integration	Business macro-environment	27.60%
Culture and change		
Supplier competence requirement		
Business transformation oriented to globalization		
Effect of globalization		

Table 6 - Cond.,

Data and information integration	Technical challenges	8.20%
Application integration		
Extranet adoption		

Based on evidences reached in this study, manufacturing firms and other organisations would have to remedy each challenge to maximise the effectiveness of integration into supply chain networks. Yet, further studies, preferably descriptive studies, are needed to explain what remedies to each challenge are. Researchers are also encouraged to further test the resulting model in the manufacturing sector and other sectors. This would buttress evidences produced in this study and make it validly entrenched in the literature.

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APPENDIX

Table 7: Constituents of Components

SN1	Component 1	SN2	Component 2	SN3	Component 3
1	Transaction cost	1	Business process integration	1	Data and information integration
2	Strategic flexibility management	2	Culture and change	2	Application integration
3	Strategic planning management	3	Supplier competence requirement	3	Extranet adoption
4	Customer order management	4	Business transformation oriented to globalization		
5	Logistic management	5	Effect of globalization		
6	Operation flexibility				
7	Measure of SC benefits				
8	Standard of trade				
9	Procurement management				
10	Enterprise integration				